

The massive glacier that formed the Great Lakes is disappearing and greenhouse gases are to blame for its untimely demise

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From a boardwalk overlooking Chicago's deserted Ohio Street Beach in the throes of winter, it's not hard to imagine the last ice age. A blanket of fresh snow covers the shoreline and pale blue ice glazes over Lake Michigan as far as the eye can see.

But this is nothing. Twenty thousand years ago, Chicago was encased in ice roughly 3,000 feet thick—twice the height of Willis Tower.

All that's left of the colossal ice sheet that sprawled over much of North America and formed the Great Lakes is a kernel of ice in the Canadian Arctic—and it's dwindling fast.

Today, the Barnes Ice Cap, a glacier about the size of Delaware on Baffin Island in Canada, is the last remnant of the mighty Laurentide Ice Sheet. But after 2,000 years of stability, the ice cap is expected to vanish in the next 300 years as an unparalleled rise in heat-trapping greenhouse gases has brought on an alarming rate of melting since the 1960s.

Scientists say the warmth of the past century exceeds any in the last 115,000 years, and perhaps even longer, according to a study published in January.

"If the Barnes Ice Cap has almost never disappeared in 2.5 million years, and it's disappearing now, then it's giving us the context that it's warm as it's ever been in the last 2.5 million years," said Gifford Miller, a professor of geological sciences at the University of Colorado Boulder and a researcher who has extensively studied the ice cap on Baffin Island.

The ice cap's improbable end is hardly a global concern by itself, but it could be a harbinger of what lies ahead for other massive ice sheets in Greenland and Antarctica, scientists say. While the Great Lakes provided a catchall for glacial meltwater, elsewhere these thawing ice sheets could send a deluge of freshwater into the oceans, contributing to [sea level rise](#) and possibly disrupting ocean currents.

In the 2.5 million years that the Earth's climate moved between ice ages and milder periods, the Laurentide Ice Sheet expanded and retreated,

shaping modern day existence in the Midwest.

It tilled what would become among the most fertile soils in the world for farmers. It altered the course of the Mississippi River, the country's largest river that shapes contemporary state lines from Wisconsin to Louisiana. And it carved out the basins of the Great Lakes, leaving behind the planet's largest system of freshwater as it melted and withdrew back to the Arctic.

"It's something you don't even think about," said Richard Berg, the director of the Illinois State Geological Survey. "But when cities were founded on it, when your food depended on it, and when glacial deposits provide a lot of the water we drink—essentially our whole lives are tied to this legacy landscape from glaciation."

Before glaciers arrived in the Midwest, Illinois was a rugged place characterized by steep hills, bluffs and deep valleys. But glaciers smoothed over most of the state, giving it its trademark flat horizon.

Each ice age, glaciers acted as a giant pestle on Illinois' landscape, pulverizing rock and prehistoric plants into the fertile soils that the Midwest is known for. Only two areas are untouched by glaciers: a pocket in the far northwest corner in the Galena area and the region south of Carbondale. There, the topography, still punctuated by jagged cliffs and lowlands, is vastly different from the rest of the state.

"Glaciers are the great homogenizer," Berg said. "You can imagine this giant sheet of ice picking up rocks, sand and sediment, and just grinding them up like the rock crushing that goes on in a factory."

The ancient Mississippi River once ran through Illinois, flowing as far east as Hennepin. But when a towering ice shelf protruded into its path, the river was diverted further west to its present-day track. When

glaciers left, their meltwater filled the Mississippi River's prehistoric course, forming the Illinois River.

As each great lobe of ice plunged into Middle America, it was rebuffed by Michigan's hard, granitic rock and limestone, but gouged out the softer sediment of the present day Great Lakes.

"Over 2.5 million years, it keeps occupying its favorite spots," Miller said. "It liked flowing through Lake Michigan and Lake Huron. The Great Lakes are the legacy on the landscape of the erosive power of these giant ice sheets."

Similar to a bulldozer, the ice sheet scooped out sediment and deposited it at the edge of its reach, forming subtle, arc-shaped formations known as end moraines in Illinois. These ridges, up to 100 feet high and five miles wide, mark the furthest reach of these massive sheets from at least six glacial periods.

Today, cities like Urbana and Champaign are formed on top of understated rolling hills. Perhaps, the last of these ridges formed the southern lip of Lake Michigan.

Seth Stein, professor of geological sciences at Northwestern University, takes his students to the North Shore to teach them about this history, which fashioned the bluff overlooking Glencoe Beach, the streams that carved out the picturesque ravines along Sheridan Road in Winnetka and the fifth largest lake in the world.

"You stand on campus and look out on Lake Michigan, and that's a product of global warming—one that's not produced by humans, it's purely natural—but it's definitely a product of global warming," Stein said.

Scientists say the Earth transitions between ice ages and warmer periods as its orbit around the sun changes over time. The Earth also experiences long-term variation in its wobble and tilt, which determines how much of the sun's energy reaches the planet.

But scientists say these cycles—which operate over tens of thousands of years—can't explain the current global warming trend for two reasons: the rate of temperature rise is too fast; and the Arctic is warming despite the Earth slowly drifting away from the sun during the Northern Hemisphere summer.

The Arctic is warming faster than anywhere else on the planet as the spike in heat-trapping gases has led to the disappearance of sea ice, which acts as a cooling agent by reflecting away sunlight. Some scientists believe warmer Arctic air temperatures are leaving the region more vulnerable to incoming warm air masses that are thinning glaciers. The polar vortex, the swirl of cold air that sits atop the North Pole, is prone to destabilizing and spilling into areas like the Midwest as the Arctic warms.

In examining the perimeters of 30 quickly melting glaciers on Baffin Island between 2009 and 2015, Miller and a team of researchers discovered places that had been blanketed in ice for more than 40,000 years are now exposed.

Unlike many glaciers that have survived in colder mountainous regions, the Barnes Ice Cap sits much lower on a stony, tundra plateau. But the 1,600-foot thick glacier has used its own height to sustain itself for much of its existence.

"It's really a true anomaly out there," Miller said. "It's like its own little mountain and it creates its own climate system there, because it's colder as you go up in altitude and it also gets more snow. But as it's melting

and lowering, that ability to get more snow is weakening.

"If it ever disappeared, it would never be able to grow back again."

In the past decade, the snowfall that frosts the top of the Barnes rarely lasts as the ice cap loses about 1 foot of height each year at its highest elevations and 3 feet near the margins, according to Miller. And streams of melting water run from its peak down to the lakes that have formed near its base.

If greenhouse gases continue to rise at their current pace, the glacier is expected to disappear around 2300.

Though the glacier will contribute little to sea level rise, scientists are more concerned about its much larger neighbor 500 miles east. The Greenland ice sheet, one of the biggest contributors to rising seas, released the equivalent of 240 million Olympic-size swimming pools into the ocean in 2012, according to a study published in December.

Researchers estimate global sea levels would rise about 20 feet if the ice sheet melted entirely.

At the South Pole, ice shelves the size of states are breaking away and becoming giant ice bergs that could dwindle and contribute to higher tides.

As more land near the poles is uncovered each year from these enormous slabs of ice, scientists say the story is a familiar one. A land smoothed by ice. Freshwater searching for a home. And an unfamiliar warmth waiting on the next ice age. In the future, perhaps the landscape of the North and South poles will resemble that of the Midwest.

"We know what can happen after the recession of the ice sheet," said

Berg, the Illinois geological survey director. "Greenland and Antarctica, they are modern day analogues of what happened here in Illinois."

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